measures). (*e*) A series of minerals and rocks, the Derbyshire minerals being specially good; and some educational sets of fossils and minerals. All the above are properly arranged with explanatory notes, so as to be useful to the uninitiated and to teach geological rudiments, whilst affording advanced students opportunity of comparing their "finds" and naming them. (*f*) A series of the fauna and flora of North Derbyshire, including mammals (stuffed), birds, and their nests and eggs, ferns and mosses, &c. (*g*) Collection of old china, entirely obtained from the older houses in the neighbourhood, with old books, ornaments, coins, &c. (*h*) Set of archaic mining tools from the old lead mines of Castleton. (*j*) The natural and commercial productions of the neighbourhood. (*k*) Geological maps and sections, guide-books, and a small scientific reference library. Mr. Pennington's collections are all included in the museum.

THE investigation into the cause of the explosion at the Jabin pit, near Lyons, in France, seems to show that the workmen were not to blame for any imprudence in the use of their lamps, but that the catastrophe was probably produced by the inflammable air escaping from the coal beds by a great diminution of barometric pressure, which reached 10 millimetres in a few hours. This connection of explosions in mines with a diminution of barometric pressure has been frequently referred to recently in connection with explosions in England. The question has been asked whether it is not desirable to extend the system of storm warnings to coal-mining districts; if the miners could only be induced to attend to them there seems no doubt that a great saving of life would be thus effected.

A VALUABLE and in many respects exhaustive memoir on the temperature of the air at Brussels, by Prof. E. Quetelet, based on forty years' observations ending with 1872, appears in Vol. XLI. of the Memoirs of the Royal Academy of Belgium. The paper presents in a more extended and permanent form the leading features of the most important element of the climate of Brussels, which appeared about a year ago in the form of a small tract, briefly reviewed in NATURE at the time (vol. xi., p. 444).

MRS. MARSHALL HALL, sen., writes that the lady who made a successful ascent of Mont Blanc on the 31st ult., mentioned in our last number, was Miss Stratton, a Welsh lady, not an American.

AN apparatus of great delicacy has lately been devised by Dr. Mosso of Turin, for measuring the movements of the blood-vessels in man. A description of it, with figures, appears in *Comptes Rendus* of Jan. 24. The arrangement of the *plethysmograph* (as it is called) consists in enclosing a part of the body, the fore-arm, *e.g.*, in a glass cylinder with caoutchouc ring, filling the cylinder with tepid water, and measuring, by a special apparatus, the quantity of water which flows out or in through a tube connected with the cylinder, as the arm expands or contracts. An opening in the cylinder is connected by a piece of caoutchouc tubing with a glass tube opening downwards into a test tube suspended from a double pulley with counterpoise to which the recording lever is attached, in a vessel containing a mixture of alcohol and water. When the vessels of the arm dilate water passes from the cylinder into the test tube, which is thereby immersed further, so that the counterpoise rises; in the opposite case water flows back from the test-tube into the cylinder, the test-tube rises, and the counterpoise descends. Among other applications of the apparatus, Dr. Mosso employs it in studying the physiology of thought and cerebral activity. The slightest emotions are revealed by the instrument by a change in the state of the blood-vessels. The entrance of a person during the experiment, in whom one is interested, has the effect of diminishing the volume of the fore-arm four to fifteen cubic centimetres. The work of the brain during solution of an arithmetical or other problem, or the reading of a passage difficult to understand, is always accompanied by contraction of the vessels proportional to the effort of thought.

THE Perthshire Society of Natural Science has recently conferred a great benefit on the City of Perth by drawing attention through one of its members, Dr. Lauder Lindsay, to the many imperfections of its water-supply. Perth, as our readers know, stands on the banks of the finest river in the kingdom, and yet its water-supply is lamentably deficient in quantity and quality. The present system of supply was organised about fifty years ago, and Dr. Lindsay brought it to the test of the universally recognised principles of sanitary science, with the result stated. Unfortunately Perth lies very low, and on that very account unusual care must be taken to keep the supply of water pure. After the lesson which Dr. Lindsay has read the inhabitants, it will be their own blame if they do not exercise what would be genuine economy, and remedy a state of matters which must undoubtedly exercise a deleterious influence on the health and prosperity of the fair city. We think this practice of bringing science to bear on matters of local importance is one quite within the sphere of local scientific societies.

THE Meteorological Commission of Allier have now twenty regular meteorological stations at different heights, varying from 686 to 3,773 feet. These stations, together with eighty others for the observation of thunderstorms, have been established for the investigation of the local climates of the department. It is resolved by the Commission, in the interests of general meteorology, to connect its observations as much as possible with those which are collected at Paris.

THE additions to the Zoological Society's Gardens during the past week include a Bay Bamboo Rat (*Rhizomys badius*) from India, presented by Mr. Jas. Wood Mason; an Anderson's Kaleege (*Euplocamus andersoni*) from Burmah, two Hill Francolins (*Arboricola torqueola*) from India, presented by Mr. W. Jamrach; a Sociable Vulture (*Vultur auricularis*), two Cape Francolins (*Francolinus capensis*) from Africa, presented by Mr. J. C. Hobbs; two White-necked Storks (*Ciconia episcopus*) from India, received in exchange; two White-backed Pigeons (*Columba leuconota*) from the Himalayas, a Tiger Bittern (*Tigrisoma brasiliense*), five Geoffroy's Doves (*Peristera geoffroii*) from South America, purchased.

THE INDUSTRIAL APPLICATIONS OF OXYGEN[1]

II.

WE must now direct our attention to a small group of proposals for extracting oxygen from the air by purely mechanical means, without the aid of any chemical action. They are founded on one or other of two physical principles, diffusion or absorption.

T. Graham, whose "inquiries into the laws of the diffusion of gases" will always be remembered as one of the most perfect of his numerous and great researches, observed in 1866[2] that air drawn through a small fissure of a thin india-rubber leaf contains the constant proportion of 41·6 parts of oxygen to 58·4 parts of nitrogen, so that half of the nitrogen of the atmospheric air is kept back, and that this mixture makes red-hot coals burn with a flame. Deville,[3] however, tested this method with regard to its industrial merits, and found that it required too much time to be considered practical.

Endeavours to utilise absorption have been made in two different ways. Messrs. Montmagnon and De Laire obtained a patent in France in 1868 for a process, founded on the observations of Angus Smith,[4] according to which charcoal takes up more oxygen

[1] Translated, by permission of the editor, from the "Report on the Development of Chemical Industry, in conjunction with friends and fellow-workers, by A. W. Hofmann." The present article, as well as the previous one, it should be understood, are by Dr. A. Oppenheim. Continued from p. 295.

[2] Graham, Compt Rend. lxiii, 471.

[3] Deville, Wagn. Jahresber., 1867, 216.

[4] Bull. Soc. Chim. [2], xi., 261.

than nitrogen from the air. They have found that 1,000 litres of charcoal absorb 925 lit. of oxygen and only 750 lit. of nitrogen. When moistened with water, 350 lit. of oxygen and 650 lit. of nitrogen are given off; so that 575 lit. of oxygen and 55 lit. of nitrogen remain, which may be extracted by means of the air pump. By repeating the same process with this gaseous mixture, they succeeded in obtaining oxygen in almost a pure state. Whether this method was ever employed on an extensive scale is unknown. But this has been the case with Mallet's[1] method, founded on the higher coefficients of absorption of water for oxygen, as compared with nitrogen. The coefficients of absorption of these gases in water are 0·025 for nitrogen, and 0·046 for oxygen. Multiplied by their volumetric proportion in the atmosphere 0·79 and 0·21, these figures yield the proportion in which these gases occur in water = 0·0197 N and 0·0097 O; or, the air absorbed in the water contains in one volume 0·67 N, and 0·33 O. If the non-absorbed nitrogen is now allowed to escape, and the absorbed mixture of the two gases is extracted from the water and submitted a second time to absorption, we shall find by multiplying their coefficients with the numbers just obtained, 0·67 (N) and 0·33 (O), that the mixture now absorbed will contain 0·525 N and 0·475 O. A third absorption will raise this proportion to 0·375 N : 0·625 O; a fourth to 0·25 N : 0·75 O; a fifth to 0·15 N : 0·85 O; that is the same relation in which the gases occur in the mixture ordinarily produced by Tessié du Motay's process. After the eighth absorption, the gas evolved is almost pure oxygen (0·973 O and 0·027 N).

Mallet's apparatus consists of a greater or smaller number of strong iron water-reservoirs, connected by forcing and sucking pumps. Into the first air is pumped through fine openings, at a pressure of about five atmospheres. After this the non-absorbed nitrogen is removed by opening a valve, and then by means of the second forcing and sucking pump the absorbed gas is drawn out of the first vessel and forced into the second. With four vessels a complete operation is performed in five minutes. If the vessels vary in size, decreasing from the first of 10 cb.m. to the fourth of 5 cb.m. in capacity, uninterrupted working will produce a result of 7,760 litres of a mixture containing 75 per cent. of oxygen per hour; or, 168 cb.m. in twenty-four hours. The cost of working and keeping this system in order is said to be trifling, and a small amount of superintendence will suffice if the machine is made automatic. Where working power is cheap, such as water power, or the lost heat of metallurgical processes, these methods might possibly be of use, especially for metallurgical processes themselves, which could be effectually assisted by mixtures containing a smaller proportion of oxygen.

Summing up the practical results of this long list of inventions, we find in the foremost rank the well-established method of Tessié du Motay. The next place is taken by the mechanical method of Mallet, just described; which, however, has not yet met with a practical verification.

We arrive at last at the question, What uses has pure oxygen hitherto served? As the supporter of combustion, we are indebted to it for warmth and light; as a means of respiration, it is the foundation of our lives.

Let us look at it then, from these three points of view. Its metallurgical uses claim our first attention. The important part it has performed in the history of platinum has been already described. We have learned to do without it in lead soldering; hydrogen or coal gas, burnt in air, supplying a sufficient quantity of heat. The example of this industry encourages us to cherish the greatest hopes for its further and wider employment. "Just as gold," says an esteemed metallurgical chemist,[2] "while it was still used in soldering platinum, destroyed its appearance by yellow marks, in the same way white soft solder offends the eye when applied to coloured metals. This unsightliness induced the Society for the Promotion of Industry in Prussia to offer a prize for the discovery of a yellow solder. It would be difficult to solve this question, unless a new easily fusible metal of a red or yellow[3] colour could be discovered. A better chance of success offers in the self-soldering of metals by means of the oxyhydrogen blow-pipe, which has already gained triumphs in the manipulation of two metals of different natures. Is it not possible with this powerful agent, which has succeeded in soldering lead with lead, and platinum with platinum, to solder every other metal and every alloy, just in the same manner; as tin with tin, copper with copper, brass with brass, silver with silver, gold with gold, and even iron with iron?

"The probability of such an innovation exists, and there is no question of the tangible benefits to be derived from it.

"We need only picture to ourselves the neatness of a workshop in which soldering is effected by means of a light, elegant gas burner, instead of the soldering iron or forge; the workman remaining uninjured by the glowing heat, smoke, and vapours, able at any moment, by the turning of a cock, to regulate the supply of heat with the greatest nicety. We need but look at the solidity of a soldering which no longer depends on a foreign substance, but is the actual blending together of the two parts, thus saving material and work, as no filing of the soldered part would be required. Such palpable advantages must silence every prejudice, and give a strong impulse to the setting on foot of thorough and persevering researches on this subject."

Since oxygen has become cheap, however, its use has likewise been recommended in that largest branch of metallurgy, the production of iron and steel.

Cameron[1] advises the use of oxygen or enriched air, as produced by Mallet's absorption cylinders, instead of common air from the bellows for high furnaces; and here it will be well to remember that the absorption of oxygen in water has already accidentally contributed to this result, in a manner which leaves room for improvement. Br. Kerl[2] calls attention to the fact that air from water blowing machines is richer in oxygen than common air. Besides, it has already been observed that charcoal, when stored up, burns with increased vigour, because it has absorbed oxygen from the air, and that this forms a valuable assistance in refining iron.[3]

Kuppelwieser[4] recommends oxygenised air for the Bessemer process, and he is of opinion that the price of Tessié du Motay's method need not be greatly reduced to allow the use of oxygen for this purpose. A great future seems here to dawn on the application of oxygen! Nevertheless, we must not omit Le Blanc's[5] objection, that the necessity of using fire-proof materials would render the economical advantages very questionable.

But turn from the metallurgical application of oxygen to its use for illuminating purposes. The discovery of the oxyhydrogen light by Drummond[6] in 1826, and its employment in surveying and for lighthouses, has destroyed every doubt as to the value of oxygen for these purposes. The reduction of the price of oxygen brought it into wider use. This time America led the way.

H. Vogel[7] found oxygen successfully employed in New York in 1870, not only for lighthouses, signals, and ordinary buildings, but also to illuminate the beds of rivers, for the building of bridges, and for various appliances of the magic lantern. The building of the great Brooklyn Bridge over the East River, then in an early stage of construction, was facilitated by twelve oxyhydrogen lamps, which consumed about 2,000 cubic feet[8] of oxygen daily. Instead of chalk cylinders, the more durable zirconium-cones were employed with great advantage, and in the same way the Théâtre de la Gaîté and the Alcazar, in Paris, were lit up with fairy-like brilliancy. In the opera house in New York, a diagram of about ten square metres was thrown on a screen of damp muslin, the lamp placed behind the stage, producing wonderful effects. The magic lantern has with the help of this light become very popular in lecture rooms, for the projection of apparatus, glass-photographs, and drawings, especially since Outerbridge[9] taught us to draw pictures with pen and ink on thin gelatine plates. The effects are easily explained when we remember that the oxyhydrogen gas yields a light sixteen-and-a-half times stronger than the same quantity of ordinary gas would yield.

The daily amount produced in 1870 by the New York Oxygen Company was 30,000 cubic feet (850 cb.m.) The oxygen is sold in iron cylinders (patent of Robert Grant, New York), nine inches in diameter and thirty inches in length, which are filled with oxygen under a pressure of twenty to thirty atmospheres.

1 Mallet, Dingl. pol. J. cic., 112, and Philipps on Oxygen, Berlin, 1874, 24 ff.
2 Clemens Winkler, Deutsche Industrieblätter, 1871, S. 182, and Zeitschr. d. Vereins deutsch. Ingen. xvi. 714.
3 For which reason the offer of reward has since that time been withdrawn.

1 Cameron, Berg-u. Hütten Zeitung, 1871, 132.
2 Br. Kerl, Grundriss der Hüttenkunde, i., 217.
3 J. pr. Chem. ci. 397; Bergwerks Freund, iii. 513.
4 Kuppelwieser, Berg-u. Hütten Zeitung 1873, 354.
5 Le Blanc, Journal f. Gasbeleucthung, 1872, 641.
6 Drummond, On the means of facilitating the observation of distant stations in geodetical operations. Phil. Trans. 1826.
7 H. Vogel, Ber. Chem. Society, iii. 901.
8 In Vogel's Report, cubic metres is printed by mistake.
9 Morton, Journal of the Franklin Institute, liii. liv. lv. See also Vogel in the passage quoted before

The cylinder is sold at one dollar per cubic foot (35 dols. per cb.m.), including the oxygen it contains under ordinary pressure; the refilling with oxygen costs five cents per cubic foot under the pressure of one atmosphere,[1] a very high price, exceeding the calculation of Kuppelwieser more than twenty-two times. Tessié du Motay tried to apply oxygen to the lighting of streets and public places. The "Places" before the Tuileries and Hôtel de Ville were at that time brilliant with light given off from zirconium-cones under the influence of coal gas and oxygen. The unsteadiness of the flame and its great cost led him to prefer the carburation of hydrogen and of coal gas, by passing the gases through a vessel of heavy hydrocarbons fixed to every lamp before it entered the burner. In this way the Boulevards were illuminated from the Rue Drouot to the Rue Scribe with seventy oxygen burners. But this method was given up, and the preparation of a very heavy gas instead of the usual coal gas was at last resorted to, to be burnt by means of oxygen. In this new form the visitor to the Vienna Exhibition met with it at the railway station, Kaiserin-Elizabeth-Westbahnhof. We are permitted to extract the following description from an unprinted report of Herr Karl Haase, director of the Berlin Gas Company, given before the Berlin Town Council:—

"The appearance of the grounds surrounding the Elizabeth railway station, and of the hall itself, lighted up by a mixture of coal gas and oxygen, is in the highest degree surprising. The effects caused by the little bluish flames are quite peculiar, and cannot be compared with any other light. The green of the trees seems more vivid, the colours of the dresses more brilliant, and, above all, the faces of the people appear clearer, every shade and colour showing almost as distinctly as in full daylight, notwithstanding which the light did not tire the eyes.

"The favourable impression made on entering the grounds is heightened on entering the large second-class waiting-room, where everything, down to the minutest detail of ornamentation, is most distinctly seen by the light of the little flames of only two moderate-sized gaseliers.

"However, the best conception of the new method of lighting is produced in the up-train station-hall. Here, in order to make the comparison more striking, the ordinary platform used by up-train passengers was lighted with heavy gas and oxygen, only half the number of jets being lit as were used on the opposite platform, where the old gas was burning with the aid of oxygen. Notwithstanding the double number of lamps and the good quality of the gas, the space lighted by the new method was incomparably more brilliant. The shadows of the candelabra, and even of the smoky flames, were perceptible on the white walls."

In spite of this favourable impression, Herr Haase comes to the conclusion that the new double gas, conducted in two pipes, is not adapted for general private use, particularly for the following reasons:—"The advantage of its brilliancy is more than counterbalanced by its cost, which in Berlin, taking the usual lighting power as the standard of comparison, would amount to double the price of the ordinary gas: the consumer would not understand the working of the cocks: the oxygen would deteriorate in the long conducting pipes, and the repairs would be expensive, &c. Although for public buildings, for shops, and some other purposes, the new method might answer, it would be impossible to lay down three gaspipes for these limited ends." This opinion stands diametrically opposed to that of Schiele,[2] who warmly recommends the new method of lighting, but it is in close accordance with the opinion stated by Le Blanc,[3] about a year before, in a report to the Town Council of Paris. This report is the result of extensive researches by Messrs. Péligot, Lamy, Troost, De Mondésir, and Le Blanc, appointed a commission for the purpose by the Prefect of the Seine in 1869. They undertook to test the method on the Place de l'Opéra, as well as in the laboratory, by burning with half its volume of oxygen, in separate burners, ordinary coal gas, Boghead gas, and gas saturated with fluid hydrocarbons according to various systems. They came to the conclusion that at equal illuminating powers Tessié du Motay's method is almost always more expensive, mostly twice as expensive, as the usual illumination. Only in one case, where the fluid hydrocarbons of Boghead coal were used for carburation, according to Levêque's method, by saturating wicks with the oil and letting the gas pass over them, the price of the new light appeared twice as cheap as the ordinary method, and that only when large burners were used, and consequently a greater quantity of light was produced.

[1] Deutsche Gewerbezeitung, 1867, 18; see also Vogel.
[2] Schiele, Journal für Gasbeleuchtung, January 1873.
[3] "Rapport de M. Félix le Blanc sur le nouvel éclairage oxhydrique," Paris, 1872. Short extracts in the Journal f. Gasbel, 1872, 641.

The calculations were of course founded on the data furnished by the Tessié du Motay Gas Company respecting the prices of oxygen, of the carburation, &c. In truth, however, it appeared that in the last-named experiment 1 cb.m. of gas, instead of taking up 50 gr. of fluid hydrocarbons, as the company pretended, actually absorbed 266 gr.; and thus the economy, to say the least, became very questionable. As to the lighting power, it was possible to increase it so as to form three to seven times the power of ordinary street-burners. But Boghead gas can also produce three times the quantity of light, in suitable burners, without having recourse to pure oxygen, and for general purposes such an intensity of light is not desired; on the contrary, the light is lessened 30 per cent. by globes or shades. The Commission came to the decision, therefore, of advising the Corporation of Paris not to authorise the laying down of oxygen pipes, but rather to leave it to the company to supply oxygen and carburetted coal-gas in portable vessels to the comparatively few who stand in need of such an increased intensity of light.

The results arrived at in Brussels were no more favourable. During the last year lighting by oxygen was tried for a short time in some cafés, as well as in the Passage St. Hubert, and then discontinued[1] on account of the aforesaid objections. In Vienna, in April 1874, the Westbahnhof was still lighted with oxygen, but the system had spread no further; for in spite of its intensity and acknowledged beauty, the bluish moonlike light did not produce anything like a general satisfaction.[2]

The jury of the Vienna Exhibition inspected the oxygen lighting at the Westbahnhof. In the Exhibition building itself, oxygen industry was not represented.

If further experiments confirm the above opinions, the industry of oxygen will have lost the root from which it commenced to grow, because wherever it has sprung up it was fostered by the hope of being employed for illuminating purposes.

Many of the alleged disadvantages, especially the cost of the laying down of pipes, are avoided in the arrangement which Philipps[3] proposed for oxygen lighting. According to this proposition lamps (manufactured by George Berghausen, of Cologne) were to be fed with very heavy tar oil containing naphthalin, whilst oxygen was introduced through the middle of the wick. It is, however, very doubtful if any larger city would renounce the advantages of gas-light in favour of this arrangement, and consequently, if there is any chance of its application on a large scale.

Let us be all the more hopeful that oxygen industry will find its saving ally in metallurgy.

In medicine it has won no friend. Up to the present time there is nothing to contradict Pereira's opinion[4] in spite of many more recent praises of the medicinal powers of oxygen,[5] and we can therefore do no better than quote it anew:—

"Soon after the discovery of oxygen, its therapeutical application was in great favour. The want of a proper supply of oxygen to the body was considered to be the cause of many diseases, such for example as scorbute, and it was asserted to have been used in many cases with brilliant success. Beddoes[6] and Hill employed it in England. The latter declares that he found it useful in cases of asthma, weakness, ulcer, humor albus, and scrofulous bone diseases.

"These opinions have nevertheless been greatly modified on chemical, no less than on physiological grounds. In cases of asphyxia, caused by want of air, or by inhaling noxious gases, the respiration of oxygen may possibly be useful. For this reason it has been administered in cases of asthma threatening suffocation. But as the patients in such cases are scarcely able to inhale it, if it acts at all, it can only act as a palliative, and is decidedly incapable of preventing fresh attacks. In most cases where oxygen has been inhaled it was therefore powerless to help; and from the physical reasons stated above, very little success can be anticipated from its employment.

[1] Letter dated April 14, 1874, of M. Melsens, Professor of Chemistry in Brussels, to A. W. Hofmann.
[2] Verbal communication of Professor Hlasiwetz.
[3] Philipps on Oxygen. Berlin, 1871, 46.
[4] Pereira, "Art of Healing," Translated into German by Buchheim, i. 217.
[5] Verbal communication of Prof. Dr. Oscar Liebreich.
[6] "Considerations on the use of factious airs, and on the manner of obtaining them in large quantities." By F. Beddoes and J. Watt. Bristol, 1794–95. There was a Pneumatic Institute established in Bristol in 1798, in which the medical properties of gases were tried, and it was here Humphry Davy discovered the effects of protoxide of nitrogen.

"This did not prevent medical speculators from opening an institution in Berlin for inhaling oxygen, where it is now being sold at 7*d.* the cubic foot, while oxygen water is sold at 2*d.* the bottle. As water of 0° does not absorb 4 per cent. of its volume, a half-litre bottle contains less than 20 cb.m., or 0·0017 grammes of this gas! It seems incredible that such a dose should be expected to produce any effect whatever. Just as travellers are recommended to provide themselves with concentrated food, those who wish to climb the highest mountain tops, or by means of balloons reach great heights, where the thinness of the atmosphere might cause them dangerous inconveniences, are advised to use pure oxygen as a concentrated means of respiration.[1] P. Bert[2] exposed himself and others in proper apparatus, to degrees of rarefaction of air, which far surpassed that of the greatest heights ever reached by man. The want of breath and symptoms of suffocation which ensued, when the barometer stood at from 300 to 250 mm., were, according to his account, at once relieved by one breath of pure oxygen. A mixture of the same with atmospheric air proved even more effectual than the pure gas, and, on an aërial voyage which the late MM. Crocé Spinelli and Sivel undertook from Paris on the 22nd of March, 1874, they provided themselves with mixtures containing 45 and 75 per cent. of oxygen to 55 and 25 per cent. of nitrogen. They were enabled by the help of this gas to make valuable physical observations,[3] at heights of more than 6,000 metres, leisurely and without any bodily inconvenience; and although Glaisher had succeeded in reaching still greater heights without this assistance, oxygen offers a means of gaining strata hitherto inaccessible."

These words, however, were scarcely written when the newspapers announced the death of the courageous navigators on a new aërial voyage; suffocation appears to have set in so suddenly as to incapacitate them at once from using their respiratory apparatus.

The physiological applications of oxygen form the bridge to some considerations on the practical uses of ozone, the discovery of which had been greeted by exaggerated hopes.

A. Oppenheim.

[1] Fonvielle (La Science en Ballon Paris, 1869), and elsewhere.
[2] Bert, Compt. Rend. 1874, 911.
[3] Compt. Rend. 1874, 946.

SOCIETIES AND ACADEMIES

London

Chemical Society, Feb. 17.—Prof. Abel, F.R.S., president, in the chair.—The president announced that Mr. James Duncan had presented the Society with a most life-like and spirited marble bust of Dr. Hofmann. He then called upon Prof. Frankland to deliver his lecture "On some points in the analysis of potable waters." A report of this we give on another page. —A full discussion of the variation in purity of the water supplied during the past eight years by the various London companies followed, illustrated by most excellent diagrams, and the lecturer concluded by pointing out some of the objections to the other well-known processes employed for water analysis.

Zoological Society, Feb. 15.—Prof. Mivart, F.R.S., in the chair.—Mr. Sclater exhibited the parrot called in Tschudi's "Fauna Peruana" *Conurus illigeri*, and observed that it had been certainly wrongly determined. Mr. Sclater was of opinion that the bird belonged to a species hitherto unrecognised, and proposed to call it *Ara couloni*, after M. Coulon, of Neuchatel, who had sent the specimen for exhibition.—Dr. Cobbold, F.R.S., exhibited and made remarks on a Parasite (*Echinorhynchus*), obtained from the Tamandua Anteater, which had died in the Society's menagerie.—Mr. W. K. Parker, F.R.S., read the second portion of his memoir on Ægithognathous Birds.—A communication was read from the Rev. O. P. Cambridge, in which he described a new order and some new genera and species of Arachnida from Kerguelen Island, from specimens collected by Mr. Eaton during the Transit of Venus Expedition.—Mr. G. French Angas communicated descriptions of four new species of land shells from Australia and the Solomon Islands, which he severally proposed to name *Helix moresbyi*, *Helix ramsdeni*, *Helix beatrix*, and *Helix rhoda*. Mr. Angas also made some remarks on the nomenclature of *Helix angasiana* of Pfeiffer, and *Helix bitæniata* of Cox.—Mr. Sclater read some notes, by himself and Mr. Salvin, on some of the Blue Crows of America, taken from specimens lately examined, and pointed out certain changes which it would be necessary to make in the nomenclature of the group adopted in their "Nomenclator Avium Neotropicalium."

Geological Society, Feb. 2.—Mr. John Evans, F.R.S., president, in the chair.—Edward Richard Alston, David Corse Glen, Thomas Vincent Holmes, William G. M'Murtrie, Charles Bine Renshaw, Robert Drysdale Turner, and George Ferris Whidbourne, were elected Fellows of the Society.—Evidence of a carnivorous reptile (*Cynodrakon major*, Ow.) about the size of a lion, with remarks thereon, by Prof. Owen, F.R.S. The specimens described by the author consist of the fore part of the jaws and the left humerus of a reptile obtained from blocks of Triassic (?) rock from South Africa, forwarded by the late Mr. A. G. Bain. The upper jaw displays a pair of enormous canine teeth much resembling those of *Machairodus*, being of a very compressed form, with the hinder trenchant margin minutely toothed. There is no dentated border to the fore part of the crown. No teeth can be detected in the alveolar border of the right ramus of the lower jaw, which extends about an inch behind the upper canine. In the symphysial parts of the lower jaw the bases of eight incisors and of two canines are visible, the latter rising immediately in front of the upper ones, to which they are very inferior in size, and being separated by a diastema from the incisors. In this character, as in the number of incisors, the fossil resembles *Didelphys*; and in structure both canines and incisors resemble those of carnivorous mammals. The left humerus is 10½ inches long, but is abraded at both extremities. It presents characters in the ridges for muscular attachment, in the provision for the rotation of the forearm, and in the presence of a strong bony bridge for the protection of the main artery and nerve of the forearm during the action of the muscles, which resemble those occurring in carnivorous mammals, and especially in the Felidæ, although these peculiarities are associated with others having no mammalian resemblances. The author discusses these characters in detail, and indicates that there is in the probably Triassic lacustrine deposits of South Africa a whole group of genera (*Galesaurus*, *Cynochampsa*, *Lycosaurus*, *Tigrisuchus*, *Cynosuchus*, *Nythosaurus*, *Scaloposauras*, *Procolophon*, *Gorgonops*, and *Cynodrakon*), many of them represented by more than one species, all carnivorous, and presenting more or less mammalian analogies, for which he proposes to form a distinct order under the name of Theriodontia, having the dentition of carnivorous type; the incisors defined by position, and divided from the molars by a large laniariform canine on each side of both jaws, the lower canine crossing in front of the upper, no ectopterygoids, the humerus with an entepicondylar foramen, and the digital formula of the forefoot, 2, 3, 3, 5; 3 phalanges. The author further discussed in some detail the remarkable resemblances presented by these early reptiles, in some parts of their organisation, to mammals, and referred to the broad questions opened out by their consideration. He inquired whether the transference of structures from the reptilian to the mammalian type has been a seeming one, due to accidental coincidence in species independently created, or whether it was real, consequent on the incoming of species by secondary law. In any case the lost reptilian structures dealt with in the present paper are now manifested by quadrupeds with a higher condition of cerebral, circulatory, respiratory, and tegumentary systems, the acquisition of which, the author thought, is not intelligible on either the Lamarckian or Darwinian hypotheses.—On the occurrence of the genus *Astrocrinites* (Austin) in the Scotch Carboniferous Limestone Series, with the description of a new series (*A. ? Benniei*), and remarks on the genus, by Mr. R. M. Etheridge, jun. The author, in his introduction to the paper, commenced with a general history of the genus *Astrocrinites* of Austin, commenting upon the change of name it had received from the several authors who had written upon and noticed the species *A. tetragonus* of Austin. In 1843 Major T. Austin described this aberrant Echinoderm under the name *Astrocrinites*, assigning its geological horizon to be the Carboniferous Limestone, and locality Yorkshire. Dr. H. G. Bronn rejected the name *Astrocrinites* on account of its resemblance to *Asterocrinites* of Münster, and proposed instead that of *Zygocrinus*. Römer, from the four-rayed structure of our *Astrocrinites*, allied it to the Cystoidea rather than to the Blastoidea. Prof. de Koninck, and M. le Hon, however, referred *Zygocrinus* to the Blastoidea, and stated their reasons for so doing. Prof. Morris, in 1854, altered Austin's *Astrocrinites* into *Astrocrinus*, and does not notice Bronn's name, *Zygocrinus*. Prof. Pictet provisionally referred the latter genus structurally to *Codonaster*,